

Silver beet growing

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Introduction

Silver beet (*Beta vulgaris* L. Cicla group) (Maynard & Hochmuth 1997) is also known as Swiss chard or seakale beet.

In Australia it is grown as a leaf vegetable. While the silver beet leaves are eaten like spinach, the stems may be cooked like celery. The seedlings can also be served in salads.

Although it looks like true spinach (*Spinacia oleracea* L.), silver beet has a larger, coarser, milder tasting leaf. It is also more tolerant of cold, heat, drought and disease.

As silver beet doesn't easily go to seed during hot weather, it is often grown over summer instead of spinach.

Both silver beet and spinach belong to the Chenopodiaceae plant family, which includes the root vegetable beetroot (*Beta vulgaris* L. Crassa group) (Maynard & Hochmuth 1997).

Silver beet, a leafy relative of beetroot, comes from the coasts of Portugal, Spain and the Mediterranean islands. From there it spread to Britain and then to Australia and New Zealand.

Figure 1. The Success variety of silver beet.



Source: Terranova Seeds (2009).

Silver beet

Silver beet is a cool season vegetable with edible leaves and stems. It has large, thick, crinkled leaves with prominent leaf ribs and stems.

Silver beet comes in a range of leaf colours, leaf textures, stem colours and plant sizes. It can grow up to 75 cm high and 25 cm wide.

Table 1. Silver beet varieties grown in New South Wales.

Variety	Growing season ¹ (weeks)	Height (centimetres)	Leaf Colour
Compacta Slo Bolt	10–14	45–50	Dark green
Fordhook Giant	9–10	Up to 75	Dark green
Fordhook Master	9–10	Up to 75	Dark green
Success	9–10	40–45	Dark green

1. Growing season: growing season from transplanting to maturity.

Source: Terranova Seeds (2009).

The stems can be white, red, pink, orange or yellow. The leaves may be smooth or crinkled. Leaf colours vary from light to dark green to deep red. In general, the paler the leaf colour the milder the leaf flavour.

Silver beet is a biennial plant. In the wild it grows leaves in its first season and produces seeds in the second season after germination.

As a vegetable crop, silver beet is grown as an annual and picked in the first season after sowing before it can go to seed.

Varieties

Compacta Slo Bolt and Success are the main silver beet varieties sown in New South Wales (NSW). They have white stems and blistered, dark green leaves.

Compacta Slo Bolt has a slower seed set and is picked over winter, while Success is grown in spring, summer and autumn. Both lines have a longer shelf life if picked as whole plants.

Fordhook Giant and Fordhook Master are also grown in NSW. They have broad, white stems and heavily crinkled, dark green leaves. Both these varieties are grown over the warmer months.

Climate

Silver beet thrives in a wide range of climates. It grows in sub-tropical, temperate and cold temperate climates.

Silver beet is well suited to coastal locations. In NSW it is grown on the coast, the tablelands and the inland districts.

For good crop growth silver beet requires a minimum monthly air temperature of 4°C, an optimum monthly air temperature of 16° to 18°C and a maximum monthly air temperature of 24°C (Maynard & Hochmuth 1997).

Silver beet prefers cool, dry, frost-free growing conditions with 16° to 24°C days and 4° to 7°C nights.

In the sub-tropical climate of the NSW north coast, the high temperatures and humidity in the warmer months increases the incidence of fungal leaf diseases.

In the cold temperate climate of the NSW tablelands, the hard frosts (0°C) and wet weather during winter can also damage the leaves of silver beet.

Site selection

Silver beet can be grown at any site with a suitable climate, good soil and reliable supplies of irrigation water.

Silver beet may be grown in full sunlight or partial shade. A sheltered site is favoured. Although it is fairly wind hardy, strong winds can cause leaf damage in open sites.

Silver beet is grown on most soil types. It does best on deep, friable, fertile, well-drained soils. Alluvial soils and sandy loams are preferred.

If drainage is a problem, the crop can be grown on raised beds as silver beet does not like waterlogged soils.

A slightly acid to neutral soil pH is preferable. A soil pH_{Water} of 6.0 to 6.8 is best, though silver beet can tolerate a soil pH_{Water} of 6.0 to 7.5. Silver beet does not like highly acid soils, which should be avoided or ameliorated to a suitable soil pH.

As a coastal plant, silver beet has a moderate soil salinity tolerance. While seed germination is inhibited by high salt levels, silver beet is quite salt tolerant after the seedling stage.

Silver beet has a similar soil salinity tolerance to beetroot. Mature beetroot plants can grow in soil with an electrical conductivity up to 4 dS/m (deciSiemens per metre) with no yield loss.

The soil must be well prepared to provide a fine, friable seedbed for sowing. It can be worked deeply as silver beet roots may go down 90 to 120 cm.

The soil surface should be smooth, level and free of clods and trash, so the seeders or transplanters can work properly.

Sowing

Silver beet can be direct sown or transplanted. It has two to six seeds in a light brown, knobby, dried

Table 2. Silver beet planting times in New South Wales.

Region	Winter			Spring				Summer			Autumn		
	J	J	A	S	O	N	D	J	F	M	A	M	
North Coast				✓	✓	✓	✓	✓	✓	✓			
South Coast					✓	✓	✓	✓	✓	✓			
Tablelands						✓	✓	✓	✓				
Inland				✓	✓	✓	✓	✓	✓	✓			

fruit called a cluster seed. The cluster seed is sown 0.5 cm deep in the soil or into seed trays for transplanting.

Silver beet crop rows are spaced 50 to 80 cm apart, depending on whether they are used for hand or mechanical cultivation and whether they are grown on flat ground or raised beds.

As silver beet has many seeds in each cluster seed, it is difficult to get uniform plant stands. Silver beet is usually overplanted and then thinned to the desired plant population.

For good seed germination, the soil should be irrigated after planting. The soil must be kept moist until the silver beet seedlings emerge.

The seed clusters are sown five cm apart along the rows. There are 30 to 90 silver beet seed clusters per gram. Sowing rates can vary from three to fourteen kilograms/hectare (kg/ha), depending on the plant population, the seed weight and the germination percentage (%) of the seed.

The germination of silver beet seed requires a minimum soil temperature of 4°C, an optimum soil temperature of 10° to 29°C and a maximum soil temperature of 35°C (Maynard & Hochmuth 1997).

Soil temperatures above 35°C cause heat induced seed dormancy. Higher sowing rates are needed in warmer soils to ensure good plant establishment.

Depending on the soil temperatures, silver beet emerges seven to ten days after sowing. Direct sown crops are thinned when the seedlings are five cm high.

Whole plant harvest crops are thinned 20 cm apart, while multiple pick crops are spaced 30 cm apart. As several plants may arise from each cluster seed, these are thinned back to one strong seedling.

Silver beet can also be transplanted after the last hard frost (0°C). The seedlings are half-hardy and can survive a light frost (2°C).

Transplants are sown 20 or 30 cm apart along the rows, depending on the method of harvest. For good establishment, the crop should be irrigated after transplanting.

On the NSW coast, depending on the site, silver beet may be sown from September to March. If sown after March, leaf growth is limited by the cooler winter months and the crop will run to seed in the following spring.

Silver beet can be sown in the NSW tablelands from November to February. In the inland areas of NSW, crops may be sown from September to March.

Fertiliser

Silver beet needs plenty of nitrogen and water for the fast growth of large, well-shaped, tender leaves.

Soil nutrient tests can be used before sowing and plant tissue analysis after planting to determine fertiliser needs. For the tests to be correctly interpreted, representative samples have to be taken from across the entire paddock.

Research has shown that a 20 t/ha silver beet crop will remove 58 kg/ha of nitrogen, 9 kg/ha of phosphorus and 76 kg/ha of potassium.

For good leaf growth, at least 30 kg/ha of nitrogen must be available at sowing and another 70 kg/ha of nitrogen during crop growth.

To supply these nutrients, growers often enrich their soils with large quantities of animal manures, composts or green manures.

Choose composts and manures with less than one milligram of cadmium per kilogram of product to minimise cadmium inputs. The animal manures need to be composted to avoid spoiling the silver beet leaves with food poisoning micro-organisms.

Applying up to 450 kg/ha of blood and bone fertiliser before sowing gives silver beet crops a good start, especially on sandy soils.

Figure 2. A silver beet leaf with boron deficiency.



Source: Ron Weir, NSW Agriculture (1993).

Highly acid soils can be limed to a soil pH_{Water} of 6.5. If magnesium is needed, dolomite may be used instead.

On alkaline soils with a pH_{Water} greater than 7.0, low cadmium natural gypsum can be spread. These fertilisers will ensure enough calcium is available to the crop at sowing.

Depending on the soil test results, up to 2.5 t/ha of limestone may be spread six weeks before sowing and worked into the soil. The soil can be irrigated after cultivation to activate the calcium in the fertiliser.

Based on the soil test results, up to 250 kg/ha of Nitrophoska[®] Blue Special or a similar product may be drilled at sowing. The basal fertiliser is placed below the seed for effective root uptake.

As well as nitrogen, phosphorus and potassium, Nitrophoska[®] Blue Special supplies sulphur, calcium, magnesium, zinc, boron and iron in a compound fertiliser granule.

After sowing, the crop can be irrigated to germinate the seed and activate the nutrients in the basal fertiliser.

Depending on the soil test results, side dress up to 75 kg/ha of urea and 15 kg/ha of sulphate of potash every four weeks over the growing season.

Apply each side dressing beside the crop rows and work them into the soil. After each side dressing the crop can be irrigated to maintain leaf growth and activate the nutrients in the applied fertiliser.

Some growers drill superphosphate at sowing as a basal fertiliser. Be careful when using regular superphosphate, as it may have high levels of cadmium, a toxic heavy metal.

Silver beet readily absorbs cadmium. Use low cadmium fertilisers with less than 100 milligrams of cadmium per kilogram of phosphorus on silver beet (less than 50 milligrams of cadmium per kilogram of phosphorus if possible).

Silver beet is tested in NSW to check that it does not exceed the maximum permitted concentration for cadmium in vegetables of 0.1 milligrams of cadmium per kilogram of fresh weight.

Table 3. Silver beet plant tissue analysis¹.

Nutrient	Deficient	Low	Normal	High	Excess
Nitrogen (%)	< 2.8	2.8-3.4	3.5-5.0	> 5.5	
Phosphorus (%)	< 0.18	0.18-0.24	0.25-0.40	> 0.45	
Potassium (%)	< 1.8	1.8-2.0	2.5-5.0	5.1-6.5	
Calcium (%)			0.7-2.0		
Magnesium (%)		0.20-0.25	0.3-0.8	1.0-1.8	
Sodium (%)			0.5-6.0	6.0-10	
Chloride (%)			1.0-6.0	6.0-10	
Copper ² (ppm) ³			5-20		
Zinc ² (ppm)	< 15	15-19	20-80		
Manganese ² (ppm)		18-20	50-200	300-800	> 1,000
Iron ⁴ (ppm)			50-200		
Boron (ppm)	6-20	20-24	25-80	100-200	
Molybdenum (ppm)		0.15	0.3-0.6		

1. Samples taken from the fourth or fifth young mature leaves, when the roots were four to six centimetres in diameter.

2. Values for copper, zinc or manganese in leaves sprayed with fungicides or nutrient sprays containing trace elements cannot give a reliable guide to the nutritional status even in washed leaves.

3. ppm: parts per million.

4. Leaf analysis is not a reliable guide to iron deficiency because of surface contamination with dirt, immobility of iron within the plant or the presence of physiological inactive iron within tissues.

Source: Weir, R.G. & Cresswell, G.C. (1993).

Figure 3. Silver beet roots with boron deficiency.



Source: Ron Weir, NSW Agriculture (1993).

Plant nutrition

To maintain leaf growth, silver beet can be tested for nutrient levels. Testing identifies any deficient or toxic nutrients. It allows the fertiliser program to be adjusted without severely affecting crop growth rates.

For plant tissue analysis, a representative crop sample of the fourth or fifth oldest leaves can be picked from young silver beet plants when the roots are four to six cm in diameter.

Nutrient deficiencies can be fixed with extra side dressings or foliar fertilisation. Nutrient toxicities may be avoided by cutting back on excess fertiliser.

Silver beet often needs boron. Boron helps to make new cells in the growing tips of the shoots and roots. Boron deficiency is more likely on soils with a pH_{Water} over 6.8.

Crops with boron deficiency are stunted and brittle. The leaves have brown spots and cracked midribs. The roots are brown inside (brown heart) and may have hollow, black centres (crown rot).

Damage due to boron deficiency is often permanent once the symptoms are seen. A pre-planting or

sowing application of 10–20 kg/ha of borax will usually stop this disorder.

Irrigation

Silver beet requires regular irrigation for good growth. Water- or nutrient-stressed crops are more likely to run to seed than well-fed ones.

The soil surface needs to be kept moist after sowing to germinate the seed, prevent soil crusting, assist seedling emergence and speed early leaf growth.

For active growth in summer, silver beet benefits from a watering every two to three days. It may be irrigated when the available soil water has been depleted by 50%.

Silver beet leaves are 93% water. While it can withstand hot weather, silver beet is not drought-resistant. It must be well watered to prevent wilting. However, if the crop has wilted, it will recover after watering.

Sprinkler irrigation is the preferred method for silver beet as it encourages leaf growth. However, good irrigation timing is needed to prevent leaf diseases from occurring with sprinkler irrigation.

In cool weather, silver beet crops have to be sprinkler irrigated in the morning. This allows the leaves to dry off before sunset. It avoids long periods of overnight leaf wetness which favours the infection of silver beet leaves by fungal diseases.

As a coastal plant, silver beet has a high water salinity threshold. It has a similar water salinity tolerance to beetroot. Mature beetroot plants can use irrigation water with an electrical conductivity up to 2.7 dS/m with no yield loss.

A late summer sown silver beet crop planted on a clay loam soil in a cool temperate climate will use two megalitres/hectare of sprinkler water over a

Figure 4. Pigweed.



Source: Jenene Kidston, NSW Department of Primary Industries (2006).

36 week growing season. Crops grown in warmer climates will require more water.

Weeds

Weeds must be managed as they compete with silver beet for light, moisture and nutrients. They also host insect pests and plant diseases.

Crop weeds can be removed by hand chipping, mechanical cultivation or registered herbicides. They should be controlled early in the season to prevent nutrients being tied up in the dead weeds.

With mechanical cultivation, knife attachments are the most effective method as they sever the weeds just below the soil surface.

The cultivation depth is critical as many weeds have feeding roots within one to two cm of the soil surface. Shallow cultivations also reduce crop root disturbance and help to aerate the soil.

Destroy any weeds in the Chenopodiaceae plant family near the silver beet crop early in the season. These weeds include amaranths (*Amaranthus* species), fat hen (*Chenopodium album* L.), pigweed (*Portulaca oleracea* L.) and saltbush (*Atriplex* species).

These weeds can be hosts for the main insect pest of silver beet, beet webworm, and the main plant disease, *Cercospora* leaf spot.

Disease

Silver beet is not seriously affected by plant diseases. *Cercospora* leaf spot (*Cercospora beticola* Sacc.) is the most common fungal disease.

It produces light grey spots with brown margins on the older leaves. These spots fall out and create holes in the leaves.

The disease is favoured by high temperatures (24° to 30°C), high humidity or long periods of leaf wetness.

It can develop within 14 days of infection under ideal conditions. The spores are spread by water droplets, wind or insects onto the younger leaves or nearby plants.

Cercospora leaf spot comes from infected seed, diseased crop trash and diseased host crops or weeds growing near the silver beet. It can be managed by crop sanitation, crop rotation and spraying with a registered fungicide.

Destroy any host weeds growing near the crop early in the season to stop infection. Do not plant silver beet near older crops with the disease. Avoid growing silver beet on the same land more than once every three years.

With infected silver beet plants, remove and burn the affected leaves. Keep the infected plants trimmed back. If crops are actively growing and picked regularly, the disease may not become established.

Figure 5. *Cercospora* leaf spot on a silver beet leaf.



Source: Lowan Turton, NSW Department of Primary Industries (2009).

Figure 6. A beet webworm moth.



Source: NSW Agriculture (1982).

Insects

Silver beet is rarely troubled by insect pests. The caterpillars of beet webworm, *Spoladea recurvalis* (Fabricius), cause damage in some seasons.

The beet webworm moths have two cm wide brown wings. They have two incomplete white bands across the forewings and one complete white band across the hind wings.

The moths lay clusters of small, flattened eggs underneath the silver beet leaves. The young larvae hatch from these eggs after three to five days. They are creamy white and later turn green with a dark line along their backs.

The green caterpillars eat the undersides of the leaves, leaving clear 'window panes' on the upper leaf surface. They grow up to two cm long, feeding on the silver beet leaves for about two weeks.

Beet webworm moths build up with the warm, wet weather that favours the growth of their weed hosts in the Chenopodiaceae plant family. They can be managed by destroying any host weeds near the silver beet crop and spraying the young caterpillars with a registered insecticide.

Harvest

Silver beet takes 8 to 10 weeks to mature. The leaves are picked when they are young and tender.

The crop is ready to harvest when the outer leaves are at least 30 cm long. The whole plant can be picked or several leaf pickings may be made over the harvest period. Silver beet is harvested by cutting or pulling off its leaves.

For a whole plant harvest, silver beet is picked by cutting off the whole plant at the plant base. A clean, sharp knife with a non-slip grip or handle guard and a short, wide, thin blade is the easiest and safest to use. Wearing gloves when picking will also reduce cuts and abrasions.

Figure 7. Beet webworm larvae on a silver beet leaf.



Source: NSW Agriculture (1982).

For multiple pickings, the outer leaves are picked by pulling them down to 2.5 cm above the plant base, leaving the central leaves behind. Pulling rather than cutting the outer leaves reduces the amount of leaf damage in later pickings.

Leaves over 40 cm long may be trimmed. Bind 10–25 leaves, 30–40 cm long, with a rubber band into a bunch weighing about one kilogram. Keep the bunches cool in the field by placing them under a damp hessian bag.

Wash or hose the bunches with clean water. Pack them into plastic crates or waxed boxes for dispatch to market. Silver beet can be picked over a 16–24 week harvest period.

Depending on the growing season and the number of harvests, NSW silver beet crops yield around 14 t/ha. Over the harvest period, the leaf size shrinks and the stem size increases with repeated pickings. The number of plants going to seed early may also increase. At this point the crop can be discarded. For continuous harvests, successive sowings in spring, summer and autumn are best.

Figure 8. Picking silver beet by leaf pulling.



Source: Stephen Wade, Industry & Investment NSW (2009).

Post harvest

Silver beet may have ice packed on it. It can be stored at a leaf temperature of 0°C and a relative humidity of 95–100% (Story et al. 1989). The leaves decay quickly and have a short storage life of one to two weeks.

Wilting is the main cause of leaf decay. Firm leaf stems can help to reduce this moisture loss. Side dressing with sulphate of potash fertiliser will improve stem firmness and storage life.

Silver beet is ethylene sensitive. If stored with vegetables that give off ethylene (e.g. rockmelons or tomatoes), it will decay even faster.

High quality silver beet leaves are clean, large, glossy and tender. They have firm leaf stems and no damaged or discoloured parts.

Silver beet is supplied to the Sydney markets all year round. The average price for silver beet in NSW ranges from \$0.50 to \$3 a bunch.

Silver beet seed is relatively long lived and can remain viable for up to four years after harvest when stored under cool, dry conditions.

Further advice

For more advice on silver beet, please contact your local District Horticulturist (Vegetables), Division of Primary Industries, Industry & Investment NSW.

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Acknowledgements

'Silver beet growing' was refereed by Tony Napier, District Horticulturist (Vegetables), Industry & Investment NSW, Yanco, and Brian Sherman, vegetable grower, Bathurst.

The author gratefully acknowledges the assistance of Tony Higgs, Russ Dei Rossi, Jenene Kidston, Sandra McDougall, Len Tesoriero, Lowan Turton and Charlie Vella in writing this Primefact.

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ISSN 1832-6668

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Job number 9650 PUB09/153